Using Technology in Educating K-6 ELL Students in Mathematics

Final project for EDF 6481

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Final Research Proposal

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**Introduction**

***Background***

The United States continually has large numbers of people migrating into its states and into its communities. Public schools are expected to accommodate the children of immigrants whether they speak English or not. During the 2010-2011 school year, there were 239,076 English Language Learner (ELL) students in Florida public schools; this accounts for 9% of total students in Florida public schools in 2010 (English language learners,” 2011). These students are provided special services to help them learn English and to accommodate them when they take tests such as the FCAT and the SAT. Many of these ELL students score low on these tests because of their low skill of reading and interpreting English. According to the Florida Department of Education, ELL students score well below English speaking students on tests such as the FCAT ("Bureau of k-12").

Based on 197,700 fourth graders and 153,000 eighth graders, Lee, Grigg, and Dion (2007) reported that National Assessment of Education Progress (NAEP) scores showed 44% of ELL students scored “below basic” compared with 16% of non-ELL students in fourth grade. This showed an apparent performance gap in mathematics between ELL and English-speaking students. The gap became wider for eighth grade students when about 70% of ELL students scored “below basic” while 27% of non-ELL students scored “below basic.”

According to Young, Holtzman, and Steinberg (2011) standardized tests favor native speakers of English, but technology may help to narrow the gap in scores between those of ELL students and students native to the English language. Research on the performance of ELLs on standardized tests has a relatively recent history, with studies dating back about two decades. Many of the studies conducted have found significant achievement gaps between ELLs and native English speakers and the average test scores of ELLs are substantially lower across most, if not all, subjects and grade levels. Duran (2006) reported that while about 30% of non-ELLs performed at or above the Proficient level on the 2003 NAEP Mathematics and Reading tests, only about 10% of ELLs did so. Furthermore, the magnitude of the achievement difference between ELLs and non-ELLs is greatest for tests that require substantial verbal processing, such as English-language arts, and smallest for mathematics tests.

The goal of the special accommodations for ELL students is to streamline their assimilation into the general population of students as quickly as possible and to increase their academic achievement. These special accommodations cost the state of Florida millions of dollars every year. In 2009, the total direct cost for ESOL/ELL was over $700,000 ("Program cost report," 2011). The percentage of ELL students in Florida schools continues with an upward trend while reports show an increase of 16% over the past 10 years ("English language learners," 2011). Such an upward trend would be expected to drive the cost of ELL programs up as well. As ELL student enrollment grows within the United States’ school systems and statistics continue to show a large gap between ELL and non-ELL student performance and achievement, it is imperative to find ways to promote mathematical skills for ELL students.

***Purpose***

Administrators constantly wrestle with the issue of allocating funds in the best ways, minority groups and their supporters need ammunition to help them win funds for their causes, and ELL students need the best resources to help them achieve academic success. With the number of immigrants continuing to rise in Florida, and in our nation, funding ELL programs will continue to be an ongoing issue for our educational systems.

The use of technology in schools has become progressively more prevalent over the past ten to twenty years.

The *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics [NCTM], 2000) and the *National Educational Technology Standards* (International Society of Technology in Education [ISTE], 2005), for both teachers and students emphasize the importance of technology in teaching and learning for K-12 (Ozel, Yetkiner & Capraro, 2008).

The purpose of this study is to analyze how using technology in the classroom effects ELL student achievement. The results could be used to shape instructional methods for ELL students in Florida, and possibly across the nation, for the most benefit to the student and to the state and local budgets. Such use of technology could allow for a more efficient way to improve ELL students’ skills, thus allowing more ELL students to achieve a level of skill to move out of “special education” classes and away from accommodations more quickly. This would save time and resources for schools as well as improve academic achievement for ELL students.

***Definition*s**

The definition of ELL used in this study was adopted from the Florida Department of Education as follows:

Florida Statutes define an English Language Learner (ELL) as “an individual who was not born in the United States and whose native language is a language other than English; an individual who comes from a home environment where a language other than English is spoken in the home; or an individual who is an American Indian or Alaskan native and who comes from an environment where a language other than English has had a significant impact on his or her level of English language proficiency; and who, by reason thereof, has sufficient difficulty speaking, reading, writing, or listening to the English language to deny such individual the opportunity to learn successfully in classrooms where the language of instruction is English” (1003.56(2)) (English language learners,” 2011).

For the purposes of this study “technology in the classroom” or a "technology class" will mean 80% of the instruction will be conducted using digital product which includes programs, games, and other pre-packaged digital learning resources. Traditional classroom or method of teaching will refer to classes where teachers use traditional lectures, handouts, textbooks for at least 80% of the instruction and learning, and use technology no more than 20% of the time. Technology classrooms will be equipped with computers for at least 50% of the students in the class, interactive whiteboards with clickers, projectors, and computer software, such as Compass Learning's Odyssey®, Accelerated Math™ or PLATO®.

Comprehensive English Language Learning Assessment or CELLA is a test the State of Florida uses to determine a student's proficiency in the English language. The test assesses a student in four areas: writing, listening, speaking, and reading. Using the test, students are ranked into four different levels. Level A is grade levels K-2, B is grades 3-5, C is grades 6-8, and D is grades 9-12 ("CELLA," 2011).

FCAT refers to the Florida Comprehension Assessment Test. The FCAT measures the student's understanding of the state standards in math, reading, writing, and science. Students in specific grade levels take the FCAT. Students in 3rd grade through 10th grade take the FCAT mathematics and reading, students in 4th, 8th, and 10th grades take writing, while students in 5th, 8th, and 11th take the science portion of the test. In the 2010-2011 school year, the state of Florida made changes to the FCAT and implemented the new FCAT 2.0, which measures students on the Next Generation Sunshine State Standards (NGSSS) and the Florida End-of-Course Assessment, which measures students on the NGSSS for specific courses in middle school and high school ("Florida Department of")

Adequate Yearly Progress (AYP) is a requirement of the Federal No Child Left Behind (NCLB) act. Through the NCLB, states, schools, and school districts have to determine how all students have performed in public schools and to see if they meet adequate yearly progress. Florida uses FCAT and other criteria, such as graduation rates and break down per group of group performance on FCAT to track AYP ("No child left").

Immediate Response Devices or IRDs are devices such as clickers or remotes that the students use to enter answers to questions that teachers provide; they allow instant feedback (Ozel, Yetkiner & Capraro, 2008). Interactive whiteboards (IWBs) are devices that allow projection of materials onto a board from a computer. The computer and whiteboard content can be controlled or manipulated using a finger, special pen, or other devices. IWBs are often mounted at the front of a classroom and allow teachers and students to interact with the computer to teach and learn.

Stanford 10, or SAT10, is a research-based, norm-referenced achievement test developed by Harcourt Assessment, Inc. It provides information on student performance based on its nationwide standardization program conducted in the spring and fall of 2002. Stanford 10 is aligned to the most current state and national standards. For example, when the Stanford 10 mathematics subtests were developed, careful attention was paid to the National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics (2000), which emphasizes the necessity of problem solving as the focus of school mathematics. The Stanford 10 content is grade- and age-level appropriate and mirrors instructional activities and materials used in exemplary academic programs today. In the Stanford 10 reading test, the test includes more items that address skills in critical analysis and strategies. Selections of poetry are now used at all levels of the test. In the Stanford 10 mathematics test, more items require reasoning and problem solving. Estimation is now tested at all grade levels, and more two- and three-step problems are included ("The new fcat," 2005).

***Research Question***

Our Research Question is: Can technology in the classroom help third grade ELL students in Florida attain greater learning gains in mathematics than traditional teaching methods do?

***Hypothesis***

Our hypothesis is that there is a greater gain in learning mathematics for ELL students using technology versus traditional classroom methods in Florida.

**Literature Review**

Learning mathematics in any language can be difficult for many students. Learning various subject matter and content in a foreign language can be difficult as well. ELL students may have compounded difficulty in learning mathematics due to not understanding the written instructions and application or story problems in addition to not understanding the basic math concepts.

NCLB placed a new focus and accountability on the achievement levels of English learners by requiring that they develop English proficiency and meet the same academic standards that all children are expected to meet by year 2014. Administrators and teachers are looking at ways English learners might progress more quickly toward proficiency on state tests, both in English language skills and in other content areas, more specifically reading and math (Center on Education Policy, 2010).

In 2001, Giancola reported that a five-year study of using technology in elementary school classrooms showed more improvement for lower achieving students than for students who scored above the 50th percentile in fall testing.

For second graders, the analysis revealed that the total minutes spent using the software in the classroom was significantly correlated with the scaled score gain in mathematics achievement (*r* D 0*:*230; *p <* 0*:*01). The amount of time spent in the classroom using the Internet was also positively correlated with mathematics achievement (*r* D: 240; *p <* 0*:*01). A small correlation was also found between reading achievement and the amount of time spent using Lightspan in the second grade classroom (*r D 0:172*; *p <* 0*:*05). No significant correlation was found between Lightspan use in the classroom and achievement for fourth graders. (Giancola, 2001)

Although students showed increased achievement in both reading and mathematics, there was a question of whether the increase in achievement was due more to the implementation of the five-year program than to the technology itself. Educational software was used in both the classrooms and the children’s homes.

Other research has also investigated using technology such as computer use as an educational tool to improve elementary students’ math competency with attention to the effects for ELL students. It is expected that the advanced technology of computers will resolve the difficulties that ELL students may experience. Computers can lend vocabulary and comprehension support for ELL students, who have difficulty in understanding instructions during the classes (Proctor, Dalton, & Grisham, 2007). ELL students can also learn at their own pace by utilizing the asynchronous features of computer-based learning (Gerbic, 2006).

In another study “Instructional Technology has been found to have positive effects on both students’ achievement in mathematics and their attitudes towards mathematics” (Ozel, Yetkiner & Capraro, 2008). The technologies used in the math classrooms for this study are calculators, IWBs, IRDs, computers and web-based applications. The authors also point out the need to have technical support for teachers and classrooms that use technology as well as the need for teachers to have the training, time, and availability of the technology they are using.

The frequent use of computers to learn math has a differential longitudinal effect on the math achievement of English-speaking and ELL students. When non-ELL Hispanic and Asian students frequently used computers for math, their math performance decreased over the time, “Hispanic: \_50 = –1.191, p < .05; Asian: \_50 = –1.771, p < .01”. On the other hand, when Hispanic and Asian ELL students used a computer frequently in math classes, their growth rates in math performance were significantly higher than those of their English-speaking peers, “Hispanic: \_51 = 1.902, p < .01; Asian: \_51 = 2.789, p < .05” (Kim & Chang, 2010).

Lopez (2010) concluded that ELL students in classrooms that used IWBs had an increase in student achievement for mathematics in both 3rd and 5th grade and for reading in 3rd grade over students who were in classrooms without IWBs. One of the recommendations of the author was for further study to determine how digital learning classrooms would affect ELL student achievement.

After review of these studies, it is evident that more research needs to be conducted incorporating technologies such as computers, IRDs, IWBs, and other significant digital products to evaluate their effects in teaching ELL students.

**Method**

***Population***

In 2010-11, Orange County public schools had 175,986 students; ELL accounted for 28,252, or 16.1%, of this student population ("English language learners," 2011). Our target population would be all 3rd-grade students in Orange County.

***Sample***

The sample for this study will come from a multi-step process. The number of schools used will depend on the number of ELL students chosen from each school and the number of classes will depend on the number of ELL students placed in each class. A total of at least 100 ELL students will be chosen to participate and each class will contain at least 5 ELL students. For each participating school, ELL students will be categorized based on 2nd-grade SAT scores and ELL level. Classes will be matched based on number of ELL students and ELL students in these classes will be matched, as closely as possible, using 2nd-grade math grades and ELL rating. The ELL students in each class will constitute a group and each group will also be matched for gender and age. One of each set of matched classes will use technology and the other will use traditional classroom methods. Matched participants will be randomly assigned to one class or the other in a matched set. If random assignment is not possible, groups will be matched to reduce posttest differences as much as possible.

Prior to being placed on the participant list, ELL students will be notified of the study and the potential to be placed in either type of class, technology or traditional. Parent permissions will be obtained and students’ 2nd-grade SAT scores will be recorded along with their current ELL level as determined by using CELLA.

***Research Design***

We will create equivalent groups for comparison and will systematically manipulate the independent variable of teaching method, traditional versus using digital technology, while attempting to maintain similarity of the groups in all other pertinent ways. This research study will, therefore, be experimental.

Experienced ELL teachers using similar pedagogies will be instructed regarding the expectations of them to use technology or traditional teaching methods and to report such use as required for the purposes of the study. If using technology, teachers will be trained to use each of the technologies. Technology teachers and classrooms will have priority support from their school’s technology support personnel. Technology classrooms will have computers for at least 50% of the students and other devices, such as IRDs, for all students. Technology usage reports will be submitted by teachers weekly and classrooms will be monitored for observation of technology use and teaching methods on a quarterly basis.

Curriculum for all classes participating will be the same and all teachers will be teaching the same concepts during the same timeframe as detailed in a pre-determined pacing guide. Students will attend their assigned classes for the duration of the study. If using technology, they will be instructed in the use of the technologies and provided with additional support when needed. Pre and post tests will be administered to provide data for comparison to determine the benefit of technology to ELL student academic achievement versus achievement for non-ELL students.

***Instrumentation***

Students will be tested using the Pearson Education Stanford Achievement Test version 10 (SAT10), open-ended format in both the fall and the spring, thus providing pre and post scores. CELLA scores will be recorded at the beginning and end of the school year or years if a longitudinal study is conducted. The instrument to be used to measure academic achievement in mathematics will be the current 3rd-grade FCAT.

A weekly report of technology usage will be used to track and confirm that the usage meets the requirements of the definitions adopted by the study. The report form will also include polling information on the types of technology used, i.e. games or other learning applications. See Appendix A for a proposed sample tracking form; this form should be checked for validity before use.

Classrooms will be monitored by observation to confirm correct and appropriate use of technology and similar pedagogies. Monitoring will occur at the middle of each 9-week quarter. See Appendix B for a sample of the form to be used during observation; this form also should be checked for validity before use.

***Procedure/Data Analysis***

FCAT, CELLA, and SAT10 scores for all participants will be gathered and categorized by type of class, technology versus traditional. Both descriptive and inferential statistics could be used when analyzing the collected data. Appropriate measures of central tendency for each category will be calculated and compared. A t-test or Chi-Squared test could also be used to further analyze the data. Measure of variance could also be used. The following comparisons would be useful in determining the effectiveness of technology usage in improving academic achievement of ELL students: scores versus total time of technology usage for each of the various types of technology used in the study; pre and post CELLA scores; pre and post SAT10 scores within the ELL students as well as between the ELL and the non-ELL students; FCAT scores of ELL versus non-ELL students; and scores itemized by school, classroom, CELLA, and FCAT.

Most important for determining the effect of using technology in the classroom to teach ELL students will be statistical analysis of before and after scores. If the improvement of ELL students over non-ELL students is determined to be significant, the hypothesis of the study will be deemed to be supported by the research and the data collected.

***Threats, Controls, and Limitations***

Possible threats that could interfere with interpretation of results and the ability to generalize the findings must be controlled as much as possible. These threats include, but may not be limited to, class sizes, number of teachers per class, types of technology used, experience and training of the teachers, and the number of each level of ELL student.

It is recognized that it is not just the use of technology that impacts learning, but, instead, it is the appropriate incorporation and use of the technology to enhance proven pedagogy that impacts the learning and academic achievement of students the most. To this effect, the researchers recommend the study be completed using experienced ELL teachers whose pedagogies also match.

Other threats that may not lend themselves to being controlled are students' attitudes toward computers, computer games, specific software, etc. and students' proficiency with computers. Parents' attitudes toward the use of technology could also pose a threat to the study. One possible threat that may not be controllable is the attrition of participants. The sample size of 100, however, will minimize the effect of attrition less than or equal to even 50%.

It is expected that teachers will cooperate with the terms of the study and that the threat of not enough usage of technology or significantly unequal usage from one classroom to another will not exist. It is imperative that each school has technical support for each technology used in the study.

One possible limitation of the study would be that skill gains may not be as large or as evident in one year as they would be over more time and the researchers would, therefore, recommend a longitudinal study over several years to determine the true benefit of using digital technology to help ELL students increase their achievement in mathematics. It is also recommended that similar studies be done in other states to confirm results for the rest of the country for generalizability across the nation.

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